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Radio-Frequency Discharge at Low Pressure: a Non-Local Problem Statement Approach

V.T. Dubrovin[a], V.Ju. Chebakova[a,*],V.S. Zheltukhin[b]

[a] *Kazan Federal University, 18 Kremlyovskaya Street, Kazan 420008, The Russian Federation*
[b] *Kazan National Research Technological University, 68 Karl Marx Street, Kazan 420015, The Russian Federation*

Abstract

Self-consistent nonlocal nonlinear mathematical CCRF discharge model is constructed. The model includes the convection – diffusion equations for electronic and ionic gas, Poisson's equation for electric field potential, the equation of balance of metastable as well as ground states neutral atoms, and stationary equation of heat conductivity for electronic and ionic gases. An algorithm for the numerical solutions of the model has been described. The results of test calculations of CCRF discharge characteristics at the interelectrode distance of 2.2 cm, the gas pressure of 13.3 Pa, the voltage amplitude of 65 V were obtained. Comparison of the results showed the accuracy of the results and proved the adequacy of the mathematical model and the method of calculation.

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Keywords: Mathematical simulation; low-temperature plasma; radio-frequency capacitive discharge; difference scheme; iterative method; local statement;

1. Introduction

Low-temperature plasma devices is used intensively in industries. Capacitive coupled radio-frequency (CCRF) discharge is effectively used in nanotechnologies for creating and modifying of nanostructures and for modification of natural polymeric materials, such as leather, fur and fabrics [1-3]. The characteristic features of the processing of this materials are a batch treatment, i.e. several samples must process at the same time. Thus an installation with

* Corresponding author. Tel.: +7-905-319-9652;
E-mail address: vchebakova@mail.ru

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